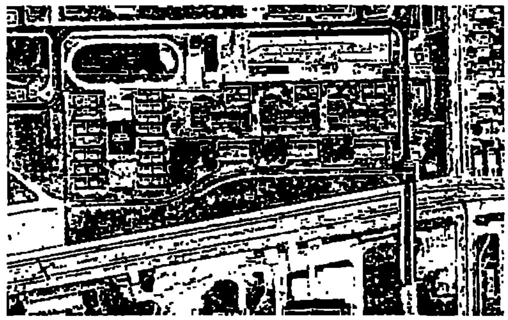
Feasibility Study Overview and Site Visit



St. Louis Ordnance Plant, Former Hanley Area

March 23, 2010

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Meeting Objectives

- Provide overview of feasibility study (FS) report
- Answer stakeholder questions on the FS
- Discuss next steps
- Conduct site visit

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Superfund

Remedial Investigation (RI) Findings

Geology and Hydrogeology

- Overburden soil: lean clay underlain by fat clay that pinches out in northern part of site. Discontinuous silt lenses in lean clay.
- Weathered shale at 20 to 25 feet below ground surface – 6 to 12 feet thick.
- Competent shale at 34 to 38 feet below ground surface. Six-inch coal seam observed within this unit.
- Groundwater in more permeable but discontinuous lenses in lean clay. Groundwater not observed in weathered shale but encountered in saturated coal seam within competent shale.
- Local flow generally from former Building 220 area to points north and northeast.

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RI Findings (continued)

Soil Contamination and Risks

- Several areas of elevated lead, arsenic, and Aroclor 1260 in surface soil (0 to 2 feet below ground surface)
  - Decision was made to remove these soils and exclude the samples from the human health risk assessment (HHRA)
- In remaining soil, HHRA found unacceptable risks to future residents associated with exposure to thallium and/or antimony in surface soil within 4 of 12 exposure units

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RI Findings (continued)

Groundwater Contamination

- Three plumes of chlorinated volatile organic compounds (VOCs) in north part of site and offsite
  - Plume A: tetrachloroethene (PCE), trichloroethene (TCE), cis-1,2-dichloroethene (DCE)
  - Plume B: 1,2-dichloroethane (DCA)
  - Plume C: carbon tetrachloride (CT)
- Refer to Figure 2-6 (handout)

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RI Findings (continued)

Groundwater Risks

- HHRA found unacceptable risks associated with
  - Onsite groundwater: hypothetical potable use to various chlorinated VOCs, benzene, manganese, and naphthalene
  - Onsite groundwater: construction worker exposure to CT (Plume C) and PCE (Plume A)
  - Offsite groundwater: hypothetical potable use to various chlorinated VOCs and manganese
- Potable use exposure is incomplete pathway because of St. Louis City Ordinance 667777, which prohibits installation of potable water supply wells.

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RI Findings (continued)

Indoor Air Contamination and Risks

- Indoor air was sampled in vacant property across Stratford Avenue from site
  - No unacceptable risk to residents was identified based on chlorinated VOC concentrations measured in air samples
- Soil gas could not be collected during RI because of tight expansive clays
- Potential for future vapor intrusion into current offsite and future onsite residents

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RI Findings (continued)

Powder well contamination

- 18 of 22 powder wells contain sediment with metal concentrations exceeding screening levels. No explosive concentrations exceeded screening levels.
- Sediment (if present) in powder wells will be removed and disposed of offsite during a removal action.

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FS Objective

Develop and evaluate remedial alternatives that:

- address unacceptable human health and ecological risks
- meet applicable or relevant and appropriate requirements (ARARs)

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FS Process

- Identify ARARs
- Develop remedial action objectives (RAOs)
- Determine preliminary remediation goals (PRGs) and areas where they are exceeded
- Evaluate chemicals of concern (COCs) against PRGs
- Develop general response actions.
- Identify and screen technologies and process options.
- Develop remedial alternatives.
- Perform detailed analysis of remedial alternatives.
- Perform comparative analysis of each alternative's ability to satisfy evaluation criteria.

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ARARs

Potential Action-specific ARARs

- Clean Air Act
- Resource Conservation and Recovery Act (RCRA)
- Missouri Air Conservation Law
- Toxic Substances Control Act (TSCA)

Potential Chemical-specific ARAR

- Departmental Missouri Risk-based Corrective Action (MRBCA) technical guidance

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RAOs

- Prevent unacceptable risk to future human receptors (onsite and offsite) from potential vapor intrusion to indoor air.
- Prevent unacceptable risk to residents from ingestion of onsite soil containing antimony and thallium within Exposure Units E, I, J, and K.
- Prevent unacceptable risk to onsite construction workers from dermal contact with groundwater containing CT and PCE.
- Remove soil to prevent future human exposure to onsite soil with elevated concentrations of arsenic, lead, and Aroclor 1260 at 8 historical sample locations.
- Remove the sediment within onsite powder wells to prevent future human exposures.

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PRGs

PRGs were developed for each COC and exposure pathway.

Soil PRGs

- Soil PRGs developed for residential exposure to thallium, antimony, lead, arsenic, and Aroclor 1260.
- Thallium, antimony, lead PRGs based on Regional Screening Levels for residential soil
- Aroclor 1260 PRG based on TSCA requirements (40 CFR 761)
- Arsenic PRG developed from a probability plot analysis of onsite arsenic concentrations

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PRGs (continued)

Groundwater PRGs

- Groundwater PRGs developed for onsite construction worker exposure to CT and PCE in groundwater.
- Based on site-specific calculations.
- Although unacceptable risks associated with CT and PCE in soil were not identified, RAOs were developed for unsaturated soil to address potential ongoing sources of contamination.
- Based on site-specific calculations and dilution attenuation factor of 1.

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Target Treatment Zones

Based on RAOs and areas with COC concentrations exceeding PRGs, target treatment zones (TTZs) were identified.

Surface Soil

- Per the RAO, 8 historic sample areas need to be addressed (lead, arsenic, Aroclor 1260)
- Two areas with thallium exceeds the PRG need to be addressed
- Refer to Figure 3-1 (handout)

Powder Well Sediment

- Powder well sediment (approximately 28 cubic yards) will be removed
- Refer to Figure 3-1 (handout)

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Target Treatment Zones (continued)

Based on RAOs and areas with COC concentrations exceeding PRGs, TTZs were identified.

Groundwater

- Plume C contains CT above the PRG. However groundwater in Plume C is deeper than 10 feet, the maximum depth for which construction exposures are considered.
- Plume A contains PCE above the PRG. The TTZ encompasses the onsite area where PCE exceed the PRG.
- Refer to Figure 3-2 (handout)

Vapor Intrusion

- Uncertainties exist with this exposure pathway.
- The non-"no action" alternatives considered in the FS include a vapor intrusion evaluation

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General Response Actions

- General response actions (GRAs) are media-specific actions that satisfy RAOs.
- Removal and disposal are the GRAs retained for surface soil contamination, based on a previous agreement to conduct a soil removal action.
- GRAs retained for groundwater and saturated soil:
  - No action (evaluated as a baseline alternative)
  - Monitoring
  - In-situ Treatment
  - Removal
  - Disposal

Technology and Process Option Screening

- Evaluated based on effectiveness, implementability, and cost
- Process options retained for groundwater and saturated soil:
  - No action
  - Groundwater monitoring
  - Chemical oxidation or reduction
  - Thermal conductive heating or electrical resistance heating
  - Excavation
  - Landfill disposal

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Remedial Alternatives

The following remedial alternatives were evaluated:

- Alternative 1—No Action
- Alternative 2—In Situ Groundwater Treatment Using Thermal Technologies, Soil and Powder Well Sediment Removal, and Offsite Disposal
- Alternative 3—In Situ Groundwater Treatment and Soil and Powder Well Sediment Removal and Offsite Disposal
- Alternative 4—Groundwater Source Removal by Excavation, Soil and Powder Well Sediment Removal, and Offsite Disposal

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Remedial Alternatives – Common Elements

Common elements shared among Alternatives 2, 3, and 4:

- TTZ delineation
- Excavation and offsite disposal of surface soil in the TTZ
- Powder well sediment removal
- Groundwater monitoring within Plume C (CT)
- Five-year performance reviews

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Remedial Alternatives – Common Elements (continued)

- Vapor intrusion evaluation
  - Groundwater will be monitored to assess possible future vapor intrusion into offsite residences
  - Groundwater monitoring may be replaced with modeling or other sampling methods as new technologies become available
  - Vapor barriers or in-home mitigation systems will be considered if evaluation concludes there is risk to human receptors

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Alternative 2 – Thermal Groundwater Treatment

- Increases temperature of contaminated soil and groundwater, which causes PCE to vaporize.
- Thermal conductive heating would be applied to the Plume A TTZ.
- Vertical heaters and vapor/groundwater extraction points would be installed. Vapor and groundwater would be treated onsite and discharged.
- Treatment time would be approximately 6 months.
- Following treatment and cooling time, groundwater samples will be collected from the TTZ.

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Alternative 3 – In-situ Groundwater Treatment

- Applies a chemical reductant or oxidant to reduce the PCE by injection or soil mixing.
- Soil mixing would be accomplished using a trenching machine to apply a chemical reductant, such as controlled-release carbon and zero valent iron for reductive dechlorination to the Plume A TTZ.
- Treatment time would be approximately 1 year.
- Following treatment, groundwater samples will be collected from the TTZ.

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Alternative 4 – Groundwater Source Removal by Excavation

- Removes groundwater contamination by excavating the soil and groundwater within the Plume A TTZ and disposing offsite.
- Excavation and disposal activities would be accomplished with standard construction equipment and trucks. Due to the excavation depth, shoring or benching would be required.
- Treatment time would be approximately 2 months.
- Performance sampling would not be required.

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Evaluation of Remedial Alternatives

In the FS, Alternatives 1 through 4 were evaluated against the following criteria, per CERCLA:

- Overall protection of human health and the environment
- Compliance with ARARs
- Long-term effectiveness and permanence
- Reduction of toxicity, mobility, or volume through treatment
- Short-term effectiveness
- Implementability
- Cost

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Comparative Analysis Results

Criteria	Alternative 1 (No Action)	Alternative 2 (Thermal Treatment)	Alternative 3 (Soil Mixing)	Alternative 4 (Excavation)
Overall protection of human health and the environment	1	4	4	4
Compliance with ARARs	1	4	4	4
Long-term effectiveness and permanence	1	4	4	4
Reduction of toxicity, mobility, or volume through treatment	1	3	3	2
Short-term effectiveness	1	3	3	3
Implementability	4	2	3	4
Cost	4	1	3	3
Total Score	**13**	**21**	**24**	**24**

1—poor 2—satisfactory 3—good 4—excellent

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Next Steps

- Receive and respond to stakeholder comments on FS report
- Finalize FS report and prepare proposed plan
- Perform pre-design investigation to refine groundwater and soil TTZs
  - Collect groundwater samples from existing monitoring wells and analyze for VOCs.
  - Install permanent monitoring well in Plume C to monitor CT concentrations.
  - Collect groundwater samples in and around TTZ to refine extent of PCE concentrations exceeding the PRG.
  - Establish excavation limits for soil removal areas.
  - Incorporate pre-design investigation into remedial design.

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TABLE 3-12
Detailed Evaluation of Remedial Alternatives
Feasibility Study Report—St. Louis Ordnance Plant, former Hanley Area, St. Louis, Missouri

Evaluation Criteria	Alternative 1 No Action	Alternative 2 In Situ Groundwater Treatment Using Thermal Technologies, Soil and Powder Well Sediment Removal and Offsite Disposal	Alternative 3 In Situ Groundwater Treatment and Soil and Powder Well Sediment Removal and Offsite Disposal	Alternative 4 Groundwater Source Removal by Excavation, Soil and Powder Well Sediment Removal and Offsite Disposal
Overall Protection to Human Health and the Environment				
Protection of human health and the environment	St. Louis Ordinance 66777 prohibits the installation of potable water supply wells in the City of St. Louis, which encompasses the site and downgradient offsite properties. Therefore, Alternative 1 protects against potable use of groundwater. Alternative 1 is not protective for RAOs pertaining to potential construction worker risks to groundwater or risks to receptors associated with COC concentrations in soil.	Alternative 2 protects against potable use of groundwater because of St. Louis Ordinance 66777. Treatment would eliminate potential construction worker risk within Plume A TTZ. Groundwater monitoring and inspections of Plume C would be protective of the potential construction worker direct contact risk by verifying that groundwater levels are deeper than 10 feet below ground and notifying hypothetical receptors accordingly, should that assumption be proven invalid during monitoring. Removal of metals and Aroclor 1260 from the soil and sediment meets the ARARs and is protective of receptors.	For the reasons described under Alternative 2, this alternative would be protective.	For the reasons described under Alternative 2, this alternative would be protective.
Compliance with ARARs				
Action-specific ARARs	In compliance.	In compliance.	In compliance.	In compliance.
Chemical-specific ARARs	Not in compliance.	In compliance. Remediation goals eventually would be met.	In compliance. Remediation goals eventually would be met.	In compliance. Remediation goals eventually would be met.
Long-Term Effectiveness and Permanence				
Magnitude of residual risk	No residual risks to potable use receptors because of the existing ordinance. Risks to construction workers would remain.	No residual risks to potable use receptors because of the existing ordinance. Residual risk to the construction worker would be minimal due to treatment and minimal exposure. No residual risk to soil COCs.	No residual risks to potable use receptors because of the existing ordinance. Residual risk to the construction worker would be minimal due to treatment and minimal exposure. No residual risk to soil COCs.	No residual risks to potable use receptors because of the existing ordinance. Residual risk to the construction worker would be minimal due to treatment and minimal exposure. No residual risk to soil COCs.

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Feasibility Study Report—St. Louis Ordnance Plant, former Hanley Area, St. Louis, Missouri

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Adequacy and reliability of controls	Reliable for the potable use exposure. No controls for the other receptors.	Reliable for the potable use exposure. Five-year reviews allow for future evaluations of the exposure pathways associated with potential future risk after the remedial actions.	Reliable for the potable use exposure. Five-year reviews allow for future evaluations of the exposure pathways associated with potential future risk after the remedial actions.	Reliable for the potable use exposure. Five-year reviews allow for future evaluations of the exposure pathways associated with potential future risk after the remedial actions.
Potential environmental impacts of remedial action	Natural attenuation would slowly reduce COC mass, but amount of reduction would remain unknown.	Excavation activities will temporarily impact nearby residents due to noise and roadway traffic.	Soil mixing and excavation activities will temporarily impact nearby residents due to noise and roadway traffic.	Excavation activities will temporarily impact nearby residents due to noise and roadway traffic.
Reduction of Toxicity, Mobility, or Volume Through Treatment				
Treatment processes used and materials treated	None.	Acceptable. Treatment processes will be utilized to reduce VOC concentrations in groundwater and soil.	Acceptable. Treatment processes will be utilized to reduce VOC concentrations in groundwater and soil.	None.
Amount of hazardous material destroyed or treated	Natural attenuation slowly would reduce concentrations of COCs in the groundwater over time, but amount of reduction would remain unknown.	Most mass would be destroyed or treated. Natural attenuation would slowly reduce concentrations of COCs in the groundwater over time. Potentially hazardous material pertaining to VOCs would be treated in soil and groundwater. Sampling would evaluate the amount of reduction.	Most mass would be destroyed or treated. Natural attenuation would slowly reduce concentrations of COCs in the groundwater over time. Potentially hazardous material pertaining to VOCs would be treated in soil and groundwater. Sampling would evaluate the amount of reduction.	Most mass would be removed from the site. Natural attenuation would slowly reduce concentrations of COCs in the groundwater over time.
Expected reduction in toxicity, mobility, or volume of the waste	Little. Natural attenuation would slowly reduce VOC mass, but amount of reduction would remain unknown.	Significant. Natural attenuation would slowly reduce VOC mass and treatment would reduce VOC mass in Plume A TTZ.	Significant. Natural attenuation would slowly reduce VOC mass and treatment would reduce VOC mass in Plume A TTZ.	Significant. Natural attenuation would slowly reduce VOC mass.
Irreversibility of treatment	Not applicable.	Complete. Once VOCs are degraded, they will not recur.	Complete. Once VOCs are degraded, they will not recur.	Not applicable.

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Evaluation Criteria	Alternative 1 No Action	Alternative 2 In Situ Groundwater Treatment Using Thermal Technologies, Soil and Powder Well Sediment Removal and Offsite Disposal	Alternative 3 In Situ Groundwater Treatment and Soil and Powder Well Sediment Removal and Offsite Disposal	Alternative 4 Groundwater Source Removal by Excavation, Soil and Powder Well Sediment Removal and Offsite Disposal
Type and quantity of residuals that will remain following treatment	Not applicable.	Ultimately no treatment residuals will remain. Concentrations of VOC daughter products such as vinyl chloride may be generated, but vinyl chloride is expected to biodegrade and not accumulate. Monitoring will evaluate the residuals.	Ultimately no treatment residuals will remain. Concentrations of VOC daughter products such as vinyl chloride may be generated, but vinyl chloride is expected to biodegrade and not accumulate. Monitoring will evaluate the residuals.	Not applicable.
Statutory preference for treatment	Does not satisfy.	Meets preference for treatment.	Meets preference for treatment.	Does not satisfy.
Short-Term Effectiveness				
Protection of workers during remedial action	Not applicable.	Treatment is not expected to create additional risk to industrial workers onsite because of the proximity of workers to the TTZ. Workers implementing the remedy would have limited potential for exposure to PCE, since remediation-derived waste may be generated only as part of monitoring well installation and abandonment activities. The surface soil removal activities were based on residential exposure risk, not industrial workers. Risks associated with heavy machinery use and with intrusive activities on the environment during the remedial action will be addressed through safe work practices and a comprehensive health and safety plan.	Treatment is not expected to create additional risk to industrial workers onsite. Workers implementing the remedy would have potential exposure to PCE, since soil mixing will expose most of the PCE within the TTZ. Risk associated with surface soil removal was based on exposure of residents, not industrial workers. Risks associated with heavy machinery use and with intrusive activities on the environment during the remedial action will be addressed through safe work practices and a comprehensive health and safety plan.	Removal activities are not expected to pose additional risk to industrial workers onsite. Workers implementing the remedy could be exposed to PCE, since excavation and removal would expose the PCE within the TTZ. Risk associated with surface soil removal was based on exposure of residents, not industrial workers. Risks associated with heavy machinery use and with intrusive activities on the environment during the remedial action will be addressed through safe work practices and a comprehensive health and safety plan.

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Protection of the community during remedial action	Not applicable.	Implementation of the groundwater TTZ alternative would have little (if any) impact to the community. Excavation and removal work associated surface soil remediation may affect the community by trucks entering and leaving the site.	Implementation of the groundwater TTZ alternative would have little (if any) impact to the community. Excavation and removal work associated surface soil remediation may affect the community by trucks entering and leaving the site.	Excavation and removal work associated with surface soil and groundwater TTZ remediation may affect the community by trucks entering and leaving the site. This alternative would have more trucks entering and leaving the site.
Potential environmental impacts of remedial action	Not applicable.	Treatment would introduce minimal impacts due to construction work, such as excavation and transportation of surface soil	Treatment would introduce minimal impacts due to construction work, such as excavation and transportation of surface soil.	Treatment would introduce impacts from construction work, such as excavation and transportation of surface and subsurface soil.
Time until protection is achieved	Protection is not achieved.	Due to the existing ordinance and depth to groundwater, protection would be achieved immediately.	Due to the existing ordinance and depth to groundwater, protection would be achieved immediately.	Due to the existing ordinance and depth to groundwater, protection would be achieved immediately.
Implementability				
Technical feasibility	Not applicable.	Feasible, but complex because of thermal treatment application and its design. An additional power source would be required.	Feasible, but complex because application of the chemical reduction amendment and design would be required.	Feasible.
Reliability of technology	Not applicable.	Reliable.	Reliable.	Reliable.
Administrative feasibility	Not feasible.	Feasible.	Feasible.	Feasible.
Availability of services, equipment, and materials	Not applicable.	Additional power sources would likely be required to operate this remedial action.	Equipment and materials are readily available.	Equipment and materials are readily available.

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Cost				
Capital cost	$0	$2,741,000	$1,875,000	$2,074,000
Present worth[a]	$0	$1,985,000	$1,985,000	$1,985,000
Period of analysis (yr)	$0	50[b]	50[b]	50[b]
Capital and present worth	$0	$4,726,000[c]	$3,860,000[c]	$4,059,000[c]
Present Cost Range (-30 / +50)	$0	$3,308,000 to $7,089,000	$2,702,000 to $5,790,000	$2,841,000 to $6,089,000

[a] Present worth of periodic costs (5-year review, operation and maintenance) are shown.

[b] Based on USEPA, 2000, *A Guide to Developing and Documenting Cost Estimates During the Feasibility Study* (EPA 540-R-00-002).

[c] Cost estimate is provided in Appendix A.

TABLE 3-13
Comparative Analysis Results
Feasibility Study Report—St. Louis Ordnance Plant, former Hanley Area, Missouri

Criteria	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Overall protection of human health and the environment	1	4	4	4
Compliance with ARARs	1	4	4	4
Long-term effectiveness and permanence	1	4	4	4
Reduction of toxicity, mobility, or volume through treatment	1	3	3	2
Short-term effectiveness	1	3	3	3
Implementability	4	2	3	4
Cost	4	1	3	3
Total Score	**13**	**21**	**24**	**24**

1—poor 2—satisfactory 3—good 4—excellent